
A Novel Approach for Subretinal Implantation of Ultrathin Substrates Containing Stem Cell-Derived Retinal Pigment Epithelium Monolayer.

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Public Summary:

Stem-cell based treatment strategies has the potency to cure diseases affecting the retinal pigment epithelium (RPE) which support photoreceptor survival and functionality. This study is intended to evaluate the feasibility of a new technique for the implantation of human embryonic stem cell-derived RPE cells (hESC-RPE) cultured as a monolayer on ultrathin parylene into the subretinal space of Royal College of Surgeon (RCS) rats which is considered as an RPE dysfunction disease model.

Scientific Abstract:

Objective: To evaluate the feasibility of a new technique for the implantation of ultrathin substrates containing stem cell-derived retinal pigment epithelium (RPE) cells into the subretinal space of retina-degenerate Royal College of Surgeon (RCS) rats. **Methods:** A platform device was used for the implantation of 4-microm-thick parylene substrates containing a monolayer of human embryonic stem cell-derived RPE (hESC-RPE). Normal Copenhagen rats (n = 6) and RCS rats (n = 5) were used for the study. Spectral-domain optical coherence tomography (SD-OCT) scanning and histological examinations were performed to confirm placement location of the implant. hESC-RPE cells attached to the substrate before and after implantation were evaluated using standard cell counting techniques. **Results:** SD-OCT scanning and histological examination revealed that the substrates were precisely placed in the rat's subretinal space. The hESC-RPE cell monolayer that covered the surface of the substrate was found to be intact after implantation. Cell counting data showed that less than 2% of cells were lost from the substrate due to the implantation procedure (preimplantation count 2,792 +/- 74.09 cells versus postimplantation count 2,741 +/- 62.08 cells). Detailed microscopic examination suggested that the cell loss occurred mostly along the edges of the implant. **Conclusion:** With the help of this platform device, it is possible to implant ultrathin substrates containing an RPE monolayer into the rat's subretinal space. This technique can be a useful approach for stem cell-based tissue bioengineering techniques in retinal transplantation research.

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